

IN THE CLAIMS:

The text of all pending claims, (including withdrawn claims) is set forth below. Cancelled and not entered claims are indicated with claim number and status only. The claims as listed below show added text with underlining and deleted text with ~~striketrough~~. The status of each claim is indicated with one of (original), (currently amended), (cancelled), (withdrawn), (new), (previously presented), or (not entered).

Please CANCEL claims 6 and 10 without prejudice or disclaimer, AMEND claims 1, 7, 9, and 11, and ADD new claims 21-27 in accordance with the following:

1. (Currently Amended) A paper edge sensing apparatus in a printer having a pickup unit and a convey unit, the apparatus comprising:

a carrier;

a printer head mounted to the carrier;

a first paper sensor mounted between the pickup unit and the convey unit to detect a top edge and a bottom edge of a paper;

a first-second paper sensor mounted to the carrier a predetermined distance from the printer head, to detect the top edge and the bottom edge of the paper; and

a controller controlling operations of the printer head according to a by comparing first top edge and first bottom edge signal-signals from the first paper sensor and second top edge and second bottom edge signals from the second paper sensor,; and

wherein a paper print margin comprises the predetermined distance between the first paper sensor and the printer head.

2. (Original) The apparatus of claim 1, wherein the ~~first-second~~ paper sensor comprises:

an optical sensor mounted in the carrier and provided and having a light emitter emitting light, a light receiver receiving light, and a reflection surface to reflect light emitted from the light emitter to the light receiver.

3. (Original) The apparatus of claim 2, wherein the reflection surface is transversely arranged across the paper convey direction.
4. (Original) The apparatus of claim 1, wherein the print margin includes a top, bottom, left, and right print margin spaced a predetermined distance from a top, bottom, left, and right edges of a sheet of paper, respectively.
5. (Original) The apparatus of claim 4, wherein the predetermined distance is in a range between 0.5 to 1mm.
6. (Cancelled)
7. (Currently Amended) The apparatus of claim ~~6~~1, wherein the ~~second~~first paper sensor comprises an optical sensor provided with a light emitter emitting light, a light receiver receiving light, and a sensor actuator rotatably mounted to the frame.
8. (Original) The apparatus of claim 1, further comprising:
an encoder detecting a movement amount of the carrier.
9. (Currently Amended) A paper edge sensing method in a printer having a first paper sensor disposed between a pickup unit and a convey unit, and a second paper sensor mounted in a fixed position relative to a moving printer head, comprising:
detecting a top edge ~~or~~and a bottom edge of a sheet of paper using the first paper sensor to output a corresponding first top edge detection signal ~~or~~and a first bottom edge detection signal;
beginning counting a start print time interval and an end print time interval upon detection, by the first paper sensor, of the top and the bottom edge, respectively;
detecting the top edge and the bottom edge of the paper using the second paper sensor to output a corresponding second top edge detection signal and a second bottom edge detection signal; and

generating a begin print command at a later of the start print time interval and the top edge second detection signal, and generating an end print command at a later of the end print time interval and the bottom edge second detection signal~~when the top edge is detected and an end print command when the bottom edge is detected.~~

10. (Cancelled)

11. (Currently Amended) The method of claim 409, wherein the printer comprises a controller and the method further comprises:

transmitting the first and second top edge detection signal~~signals~~ and the first and second bottom edge detection signal~~signals~~ to the controller;

counting the start print time interval and the end print time interval using the controller;

comparing the start print time interval to the first-second top edge detection signal and the ~~second-end~~ print time interval to the first-second bottom edge detection signal using the controller; and

controlling operation of the printer head based on a command from the controller.

12. (Original) The method of claim 9, wherein the printer comprises a pickup unit and a convey unit and further comprising:

controlling dynamic power switching from the pickup unit to the convey unit with the controller.

13. (Original) The method of claim 9, further comprising:

detecting a left edge or a right edge of the sheet of paper when the first paper sensor moves transversely to the left edge or the right edge of the sheet of paper.

14. (Original) The method of claim 9, the printer comprising the first paper sensor and the printer head mounted to a movable carrier and the method further comprising:

identifying a first detection signal as either of the first top edge detection signal or the first bottom edge detection signal if the first detection signal is generated when the carrier is located at an initial position in a central portion of a width of a sheet.

15. (Original) The method of claim 9, the printer comprising the first paper sensor and the printer head mounted to a movable carrier and the method further comprising:

identifying a first detection signal as either a first right edge detection signal or a first left edge detection signal if the first detection signal is generated when the carrier is located outside of an initial position in a central portion of a width of the sheet.

16. (Original) The method of claim 9, the printer comprising a pickup unit and further comprising:

picking up the sheet to print thereon.

17. (Original) The method of claim 9, further comprising:

selecting a general print mode to place margins on the sheet.

18. (Original) The method of claim 9, further comprising:

selecting a borderless print mode such that no margins are placed on the sheet.

19. (Original) The method of claim 9, further comprising:

tracking a position of the first paper sensor.

20. (Original) The method of claim 9, further comprising:

externally discharging an image-printed sheet from the printer.

21. (New) The apparatus of claim 1, wherein:

the controller determines a print start timing as a later of:

an estimated timing of the top edge reaching a print position proximate to the printer head based on the first top edge signal and a speed of the paper moving through the printer, and

the second top edge signal.

22. (New) The apparatus of claim 1, wherein:

the controller determines a print stop timing as a later of:

an estimated timing of the bottom edge moving beyond a range of an upstream end of the printer head based on the first bottom edge signal and a speed of the paper moving through the printer, and

the second bottom edge signal.

23. (New) The apparatus of claim 1, wherein the controller controls the printer head to print within the print margin, to achieve a borderless image on the paper.

24. (New) A paper edge sensing apparatus for borderless printing in a printer having a pickup unit, a convey unit, a carrier, and a printer head connected with the carrier, the apparatus comprising:

a first paper sensor mounted between the pickup unit and the convey unit to detect a top edge and a bottom edge of a paper;

a second paper sensor connected with the carrier, to detect the top edge and the bottom edge of the paper; and

a controller comparing first top edge and first bottom edge signals from the first paper sensor and second top edge and second bottom edge signals from the second paper sensor, to control the printer head to start and stop printing on the paper.

25. (New) The apparatus of claim 24, wherein the controller controls the printer head to print on the entire paper, to achieve a borderless image on the paper.

26. (New) A paper edge sensing apparatus in a printer, comprising:

a carrier;

a printer head mounted to the carrier;

a first paper sensor mounted to the carrier a predetermined distance from the printer head and detecting a top edge, a bottom edge, and left and right edges; and

a controller controlling operations of the printer head according to a signal from the first paper sensor,

wherein a paper print margin comprises the predetermined distance between the first paper sensor and the printer head.

27. (New) A paper edge sensing method in a printer having a first paper sensor mounted in a fixed position relative to a moving printer head, the method comprising:

detecting a top edge, a bottom edge, and at least one of left and right edges of a sheet of paper using the first paper sensor, to output a corresponding first top edge detection signal, a first bottom edge detection signal, and at least one of left and right edge detection signals; and

generating a begin print command, an end print command, and at least one of left and right edge print commands when the top edge, the bottom edge, and the at least one of the left and right edges are detected.

INTRODUCTION:

In accordance with the foregoing, claims 6 and 10 have been cancelled without prejudice or disclaimer, claims 1, 7, 9, and 11 have been amended, and claims 21-27 have been added. No new matter is being presented, and approval and entry are respectfully requested.

Claims 1-5, 7-9, and 11-27 are pending and under consideration.

REJECTION UNDER 35 U.S.C. §102:

In the Office Action, at page 2, second paragraph, the Examiner rejected claims 1-4, 6-16, and 20 under 35 U.S.C. §102 (b) as being anticipated by Tung et al. (U.S. 6,435,641 – hereinafter Tung). The reasons for the rejection are set forth in the Office Action and therefore not repeated. Applicant traverses this rejection and respectfully requests reconsideration.

Applicant respectfully submits that Tung is not a valid reference under 35 U.S.C. §102(b), since Tung was issued August 20, 2002, and the subject application claims a foreign priority date of August 6, 2002. Applicant, however, submits the following additional arguments.

Amended, independent claim 1 recites: "...a first paper sensor mounted between the pickup unit and the convey unit to detect a top edge and a bottom edge of a paper; a second paper sensor mounted to the carrier a predetermined distance from the printer head, to detect the top edge and the bottom edge of the paper; and a controller controlling operations of the printer head by comparing first top edge and first bottom edge signals from the first paper sensor and second top edge and second bottom edge signals from the second paper sensor...."

And amended, independent claim 9 recites: "...detecting a top edge and a bottom edge of a sheet of paper using the first paper sensor to output a corresponding first top edge detection signal and a first bottom edge detection signal; beginning counting a start print time interval and an end print time interval upon detection, by the first paper sensor, of the top and the bottom edge, respectively; detecting the top edge and the bottom edge of the paper using the second paper sensor to output a corresponding second top edge detection signal and a second bottom edge detection signal; and generating a begin print command at a later of the

start print time interval and the top edge second detection signal, and generating an end print command at a later of the end print time interval and the bottom edge second detection signal.”

While the device disclosed in Tung has both a media sensor 328 and an optical sensor 330, in the first of the two printing modes, the optical sensor is not employed. (See Tung, at col. 6, line 39 – col. 7, line 12). In the second printing mode, in which three or more sheets are printed, the media sensor 328 is employed to determine a leading edge of a first unit of paper 12 and a trailing edge of the first unit of paper 12, to position the leading edge for printing, and to determine a length of the first unit of paper 12. (See Tung, at col. 8, lines 36-47, and col. 9, lines 18-27).

In the second printing mode, the media sensor 328 is also employed to determine a leading edge of a second unit of paper 12. But the media sensor 328 is not employed to determine a trailing edge of the second unit of paper, “...because media sensor 328 cannot be relied upon to sense the trailing edge of the second unit of paper 12 in the second mode of operation.” (Tung, col. 9, lines 64-66).

Instead, the “...processor 320 determines (by looking at counts from rotary position encoder 316) if the trailing edge of the second unit of paper 12 reaches the nip region between the pinch rollers using the count of rotary position encoder 316 obtained from media movement controller 318 at the detection of the leading edge of the second unit of paper 12, the length of the second unit of paper 12, and the known distance from lever 332 of media sensor 328 to the nip region.” (Tung, col. 10, lines 39-47).

The device disclosed in Tung then employs the optical sensor 330 to determine a leading edge of a third unit of paper 12 (and presumably the leading edges of any additional units of paper 12). (See Tung, at col. 11, line 23 – col. 12, line 16).

Tung is unclear as to which sensor determines a trailing edge of the third unit of paper (see Tung, at col. 14, lines 12-21), but regardless, there is no comparison between detections by the media sensor 328 and the optical sensor 330 for any unit of paper 12.

Thus applicant respectfully submits that Tung neither discloses nor suggests “...a controller controlling operations of the printer head by comparing first top edge and first bottom

edge signals from the first paper sensor and second top edge and second bottom edge signals from the second paper sensor....”

Additionally, applicant respectfully submits that Tung neither discloses nor suggests “...detecting a top edge and a bottom edge of a sheet of paper using the first paper sensor to output a corresponding first top edge detection signal and a first bottom edge detection signal; beginning counting a start print time interval and an end print time interval upon detection, by the first paper sensor, of the top and the bottom edge, respectively; detecting the top edge and the bottom edge of the paper using the second paper sensor to output a corresponding second top edge detection signal and a second bottom edge detection signal; and generating a begin print command at a later of the start print time interval and the top edge second detection signal, and generating an end print command at a later of the end print time interval and the bottom edge second detection signal.”

Applicant respectfully submits that claims 1 and 9 patentably distinguish over the cited art, and should be allowable for at least the above-mentioned reasons. Further, Applicant respectfully submits that claims 2-4, and 7-8, which ultimately depend from independent claim 1, and claims 11-16, and 20, which ultimately depend from claim 9, should be allowable for at least the same reasons as claims 1 and 9, as well as for the additional features recited therein.

REJECTION UNDER 35 U.S.C. §103:

In the Office Action, at page 3, paragraph 2, the Examiner rejected claims 5, 17-19 under 35 U.S.C. §103 (a) as being unpatentable over Tung. The reasons for the rejection are set forth in the Office Action and therefore not repeated. Applicant traverses this rejection and respectfully requests reconsideration.

Applicant respectfully submits that for at least similar reasons as those stated in the section regarding the rejection under 35 U.S.C. §102, claim 5, which depends ultimately from claim 1, and claims 17-19, which depend from claim 9, should be allowable for at least the same reasons as claim 2, as well as for the additional features recited therein.

NEW CLAIMS

Applicant respectfully submits that for at least similar reasons as those stated in the section regarding the rejection under 35 U.S.C. §102, new claims 21-27 patentably distinguish over the cited art and should be allowable.

CONCLUSION:

In accordance with the foregoing, Applicant respectfully submits that all outstanding objections and rejections have been overcome and/or rendered moot, and further, that all pending claims patentably distinguish over the cited art. Thus, there being no further outstanding objections or rejections, the application is submitted as being in condition for allowance which action is earnestly solicited.

If the Examiner has any remaining issues to be addressed, it is believed that prosecution can be expedited by the Examiner contacting the undersigned attorney for a telephone interview to discuss resolution of such issues.

If there are any underpayments or overpayments of fees associated with the filing of this Amendment, please charge and/or credit the same to our Deposit Account No. 19-3935.

Respectfully submitted,

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